PRELIMINARY DATA: JANUARY 1975

WM 01 watch module

general description

The WM 01 is a complete, calibrated and warranted 3 1/2 digit LED watch module. It is designed to fit in a standard 13 ligne case (1.152 inch diameter) with two push buttons and backside battery hatches. Included within the WM 01 are the CMOS timer chip, two LED driver chips, four digit LED display chips, 32,768 Hz crystal, oscillator circuitry, timing adjustment capacitor and battery contacts. Also included are 2 spring switch contacts and special debounce circuitry to insure positive circuit actuation.

One button controls the display readout. HOURS and MINUTES are displayed for two seconds followed by blinking SECONDS. A wide viewing angle results from the single plane monolithic LED construction.

Low power consumption permits more than 20 time checks per day for one year on a single pair of 1.5V, 170 mA hour batteries. Indefinite shelf life can be obtained by use of the battery saver feature.

Designed for rugged service, the WM 01 oscillator crystal is mounted in a shock absorbing potting compound. Handling and environmental protection are provided by a specially developed coating over all the semiconductor components.

features

- HOURS, MINUTES, and SECONDS readout
- Pretested and calibrated
- One button viewing
- Fits standard 13 ligne case
- Field adjustable
- Battery saver function
- Rugged construction
- Large 2.5mm display

TIMING FUNCTIONS

HOURS: 1–12 displayed.

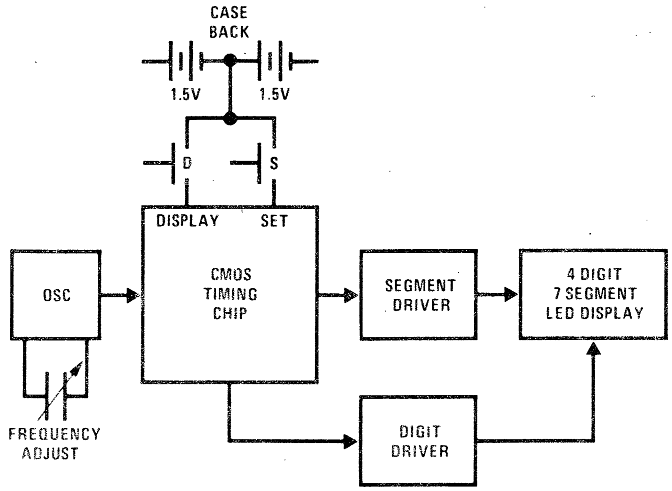
MINUTES: 00–59 displayed.

SECONDS: 00–59 displayed.

HOURS/MINUTES Display Duration: 1.5 to 2.0 seconds on.

SECONDS Display Duration: 0.5 seconds on, 0.5 seconds off, continuous blinking during switch closure.

block diagram



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absolute maximum ratings

Supply Voltage	5V
Operating Temperature Range	−5°C to +60°C
Storage Temperature	−35°C to +70°C

tentative electrical characteristics (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current	Display Off, $V^+ = 3.0V$			15	μA
	Display Off, $V^+ = 3.0V$, Oscillator Stopped		0.1	2	μA
	14 Segments Lit, $V^+ = 2.7V$		50	62	mA
	21 Segments Lit, $V^+ = 2.7V$		75	93	mA
Accuracy	Initial Factory Setting (Note 4)	−1	±0.5	+1	Min/Yr
	One Year Drift		+2.5		Min
Frequency Adjustment Range		+5, −10	±15		Min/Yr
Luminous Intensity Mismatch	Between Segments and Digits		(Note 2)		
Luminous Intensity/Segment	$V^+ = 2.7V$	20			μcd
Time Change with Temperature	Average Temperature 37°C		−4		Min/Yr
	Average Temperature 31°C (Note 3)		0		Min/Yr
	Average Temperature 25°C		+1		Min/Yr

Note 1: All specifications apply at a module temperature of 25°C and for $V^+ = 2.9V$, unless otherwise specified.

Note 2: Not discernible to the eye.

Note 3: Average temperature of a watch on the wrist is 31°C.

Note 4: Initial accuracy can be affected by the case and may require readjustment to compensate.

DISPLAY READOUT

Display switch alone is used for display readout. Close display switch and HOURS and MINUTES will be displayed for 1.5 to 2.0 seconds. Continue holding display switch closed and SECONDS will appear, continually blinking on and off at a 0.5 second on — 0.5 second off rate.

TIME SETTING

Two switches, Display and Set, are used for time setting. Set switch is used only for time setting and is usually a recessed push button.

Step 1

HOUR Setting: Close Set switch. The display will light and HOURS will advance at a 1 Hz rate. Open Set switch when the desired HOURS are reached.

Step 2

SECONDS Setting: Close Display switch, then while holding Display switch, also close Set switch. The instant Set switch closes, SECONDS resets to 00 and automatically starts counting at the normal 1 second rate (even though display and set remain closed). Usually it is desired to set the watch to a precision time standard. This is easily accomplished by making the Set switch closure at the instant the time standard says 00 seconds.

Step 3

MINUTE Setting: With the Display and Set switches still closed at the completion of step 2 above, minutes will advance at a 1 Hz rate. Open the Set switch when the desired minutes are reached.

BATTERY SAVER

A special feature has been included within the WM 01 to turn off the module for zero power consumption during shipping or shelf storage of the watch. To turn off, close and immediately open the Display switch. Then while HOURS and MINUTES are displayed, close and immediately open the Set switch. The watch is now turned off. To restart, simply close the Set switch momentarily.

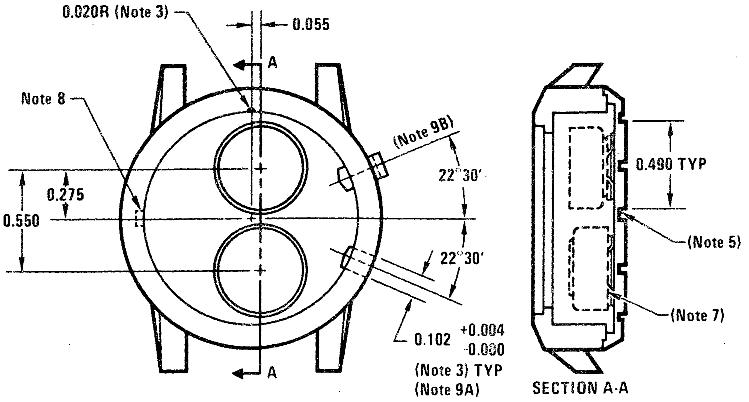
TIMING ADJUSTMENT

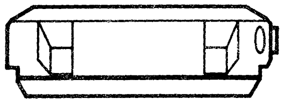
The WM 01 oscillator frequency is adjusted at National to an initial accuracy equivalent to 30 seconds per year. If future adjustment is required, it can be easily accomplished with the required equipment. Required equipment includes a 3.0V, 100 mA power supply and a frequency meter capable of measuring 1 second to an accuracy of 1 x 10^{-7} with a resolution of 7 digits.

Simply power up the WM 01 and connect the frequency meter between the frequency test point and WM 01 negative battery contact. Alternatively, a temporary back with probe holes can be used and the meter connected between the test point and case.

Next, turn the frequency adjust capacitor for slower or faster operation. The optimum accuracy reading is between 244.1404 and 244.1408 micro seconds at a case temperature of 28°C.

typical case





All dimensions are in inches.

This is a typical case drawing and is only intended to show the interface with National Semiconductor WM 01. This case should not be taken as complete, and no responsibility can be taken by National Semiconductor for its accuracy.

Note 1: Suggested crystal should have the following light transmission characteristics: 85% transmission at 6600Å, 90% absorption at 6300Å, acrylic can be dyed with Du Pont oil red. Glass can be equivalent to Corning no. 2403.

Note 2: The cavity, including all holes and ports shall conform to federal trade commission water resistant guide lines.

Note 3: Notch on case can be used as an optional alignment feature. A 0.040 dowel can be inserted between WM 01 and the case. Angular orientation of the movement in the watch case is controlled to within ±30' by pusher tubes engaging the corresponding slots on the movement block WM 01.

Note 4: A snap in spring back shall withstand an internal opening force of 15 pounds distributed evenly over bottom surface.

Note 5: No threads shall be showing when case completely closed, and a minimum of 2 threads shall be engaged.

Note 6: Battery contacts are to be corrosion resistant contacts; cannot have more than 0.1Ω resistance between contact points.

Note 7: When case closed, battery springs will be in indicated area. Because of module and battery tolerances the battery spring contact shall have a 0.026 inch deflection range. Contact force shall be a minimum of 50 grams over total range. Contact force shall not be lower than minimum after 100 full deflections.

Note 8: Back of case is keyed for alignment of battery hatch at 3:00 o'clock position.

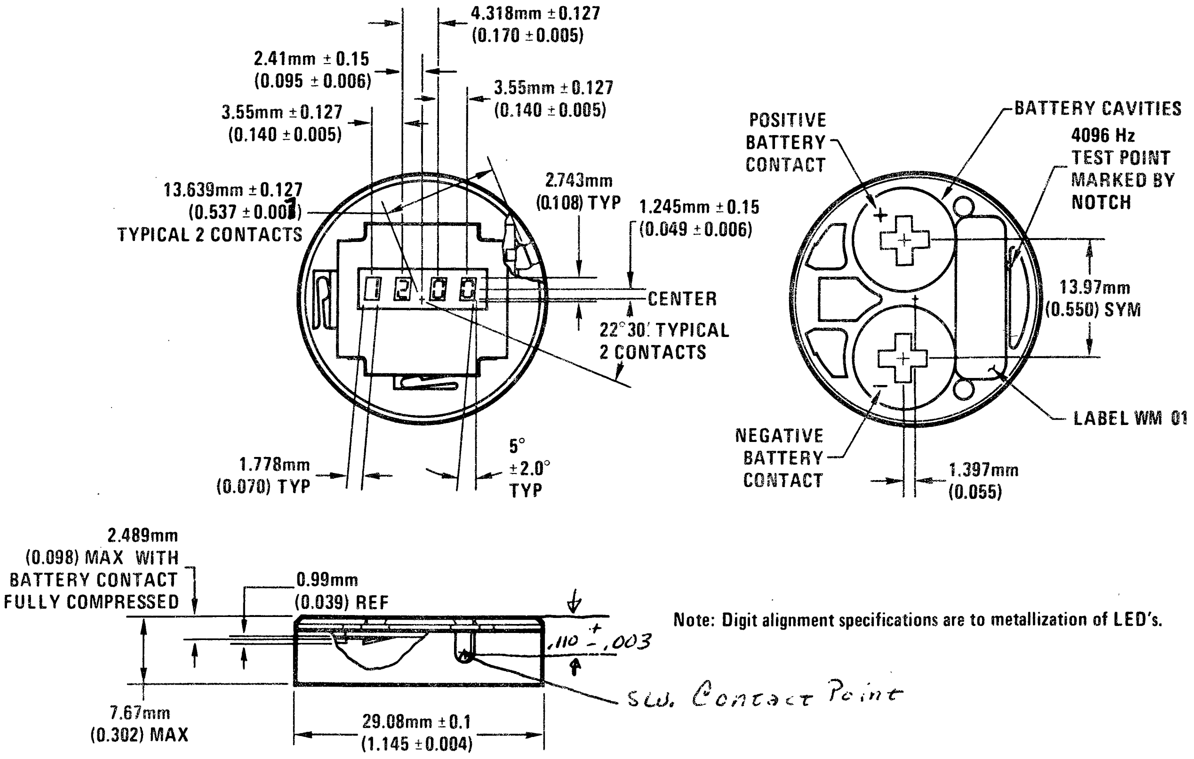
Note 9: Button switches shall depress into case and be self-returning. Button A is countersunk and can only be depressed with pointed tool. Button B is depressed with finger. Both buttons will not actuate with less than 150 grams and will fully depress with 250 grams force. Point on switches at rest is 0.552 inches from center, contact position 0.537, full penetration 0.512. Plunger shall be common with battery contact springs on case back with maximum resistance of 50Ω under all conditions. Point of plunger not to exceed 90° cone.

Note 10: Batteries: 175 MAH high rate silver oxide batteries must be used of maximum dimension ~~0.460~~ 0.455 x 0.220 inches (suitable sources are Ray-O-Vac RW22, Eveready 357, Mallory 10L14).

WARRANTY

Seller warrants that the watch module furnished hereunder will, for a period of eighteen (18) months following the date of invoice, be free from defects in material and workmanship under normal use and service and will conform to Seller's applicable specifications, or, if appropriate, to specifications accepted by the Seller therefore. Seller's sole obligation hereunder shall be limited to, at Seller's option, either repairing, or replacing, any products for which written notice of non-conformance hereunder is received by the Seller within the above warranty period; provided, such non-conforming products are, with the Seller's prior written authorization, returned without batteries or case, F.O.B. to Seller's plant of origin, freight charges prepaid, within thirty (30) days after such eighteen (18) month period. Any such replacement or repair shall not extend the original period within which such warranty can be asserted. In no event will the Seller be liable for any incidental or consequential damages. This warranty does not apply to products in other than their original condition, or to any products which Seller determines have been the subject of mishandling, misuse, neglect, improper testing, repair, alteration, or damage. *This Warranty extends to Buyer only and not to Buyer's customers and is in lieu of all other warranties whether express, implied, or statutory including implied warranties of merchantability or fitness.*

physical dimensions



Note: Digit alignment specifications are to metallization of LED's.

Order Number WM 01

Manufactured under one or more of the following U S patents 3083262, 3189758, 3231797, 3303356, 3317671, 3323071, 3381071, 3408542, 3421025, 3426423, 3440498, 3518750, 3519897, 3557431, 3560765, 3566218, 3571630, 3575609, 3579059, 3593069, 3597640, 3607469, 3617859, 3631312, 3633052, 3638131, 3648071, 3651565, 3693248.

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